

Prehistoric NIME: Revisiting Research on New Musical Interfaces in the Computer Music Community before NIME

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ABSTRACT

The history of the New Interfaces for Musical Expression (NIME) conference starts with the first workshop on NIME during the ACM Conference on Human Factors in Computing Systems in 2001. But research on musical interfaces has a rich "prehistoric" phase with a substantial amount of relevant research material published before 2001. This paper highlights the variety and importance of musical interface-related research between the mid-1970s and 2000 published in two major computer music research venues: the International Computer Music Conference and the Computer Music Journal. It discusses some early examples of research on musical interfaces published in these venues, then reviews five other sources of related literature that pre-date the original NIME CHI workshop. It then presents a series of implications of this research and introduces a collaborative website that compiles many of these references in one place. This work is meant as a step into a more inclusive approach to interface design by facilitating the integration of as many relevant references as possible into future NIME research.

Author Keywords

NIME, ICMC, CMJ, Historical, theoretical or philosophical discussions about designing or performing with new interfaces

CCS Concepts

•Applied computing → Sound and music computing; Performing arts; •Human-centered computing → Interaction design;

1. INTRODUCTION

Several publications from the international conference on New Interfaces for Musical Expression (NIME) have focused on various aspects of the research in the NIME community. Among these, a comprehensive book compiling a selection

of NIME research papers over fifteen years (2001 - 2015) [50], each of them put into perspective by their authors and by experts [49], as well as many research papers looking into research practices in NIME research. Among them, works on "the notion of community as commonly employed within NIME discourses" [64], the role of terminology in NIME, e.g. what is meant by "gesture" [48] or "evaluation" [7], as well as contributions arguing for a more inclusive history of the NIME community [9]. Such papers present an invaluable insight into the community itself, bringing up the strengths and limitations of our current research.

A common trend amongst these references, though, is to limit these analyses to the research published since the inception of NIME in 2001 and only look at research papers published in the NIME conference proceedings. These limitations are not necessarily major issues, provided they are duly acknowledged and adequately justified with respect to the context being addressed. Unfortunately, this acknowledgment is not always explicitly made in review papers or books. Indeed, this exclusive focus on research papers published on NIME events risks a) disregarding decades of relevant previous research on musical interfaces, b) ignoring pertinent recent papers published in other venues or c) not taking into account other forms of information from NIME events.

This paper partially addresses item a) by revisiting musical interface research published in the computer music community before the establishment of NIME. It presents early perspectives on musical interface design and posits that several of these works, having established many of the research topics seen at recent NIME conferences, are still relevant today. It also shows that several smaller communities interested on musical interfaces existed and were active at different times prior to 2001, though the NIME workshop was the essential catalyst needed to bring these and other communities together. The following sections introduce early discussions on musical interfaces, focusing on works from the mid-1970s to 2000 in the computer music community's two main publication venues, *the International Computer Music Conference (ICMC)* and *the Computer Music Journal (CMJ)*. The paper then reviews five other primary resources directly related to current topics at the NIME conference, highlighting the innovative aspects of pre-NIME research outside the ICMC and CMJ. Finally, the paper discusses several implications and limitations of this research, providing suggestions for incorporating these earlier references into future research by the NIME community.

2. COMPUTER MUSIC INTERFACES

Electronic music has a rich history, with innovative instruments built (and, for some, extensively used) by many peo-



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NIME'23, May 31–June 2, 2023, Mexico City, Mexico.

ple for several decades [26]. Research in computer music, though more recent, is roughly as old as digital computers themselves [33] [5] [87]. Though different facets of computer music were already present at the dawn of the field, e.g. computer-aided composition and sound synthesis, interactive computer music systems took a bit longer to appear, with early examples introduced in the 1960s [69] [83].

In the 1980s, the introduction of the *Musical Instrument Digital Interface (MIDI)* [63] and the appearance of portable digital synthesizers were significant breakthroughs for NIME research. Not only could these instruments send & receive MIDI signals, but digital synthesizers also offered easy storage and retrieval of presets, allowing for straightforward experimentation with radically different sounds at one's fingertips. Nevertheless, input devices used with computer music systems were mainly limited to keyboards, sliders, knobs, switches and joysticks.

The need for innovative devices liberating users to perform gestures not captured by existing computer input devices was clearly stated by L. Sasaki and colleagues already in 1981 [94]:

Conventional computer input devices (such as sliders, joysticks, tablets, and keyboards) are being used to increased advantage [...] However, additional research is required to design new devices which lend themselves to the articulate expression of musical gestures.

And later by W. Buxton, in J. Appleton's 1984 article on the use of real-time performance systems [4]:

A major problem of synthesizers to date, especially recently, is that they constrain the performer to express ideas through a limited set of gestures. (Ironically, some electronic instruments from the 1930s to the 1960s were more flexible in this regard.) This "straitjacket" of most "over-the-counter" systems (for example the piano-type keyboard synthesizer), has meant that in many cases, the medium of expression is totally at odds with the musical idea. To follow on this, then, if gesture and idea are tied, and the device is the instrument for capturing the gesture, then the range of input devices could be as diverse as the range of musical ideas.

It is interesting to note that shortly afterwards, a significant breakthrough destined to become a landmark in NIME was introduced, M. Waisvisz's *The Hands* [110]. It was one of the earliest examples of musical interfaces that did not resemble existing acoustic or electric musical instruments. Even though the number of musical interfaces developed grew steadily since then, *The Hands* has become an icon to NIME¹, having been showcased multiple times at early NIME conferences². It has been extensively used by Waisvisz for more than 20 years [103], demonstrating that musical interfaces can become long-term performance instruments.

3. PUBLICATION VENUES

This section focuses on two of the oldest academic venues for research on musical interfaces: the International Computer

Music Conference (ICMC) and the Computer Music Journal (CMJ). Though several other sources are also important, for instance, the journals *Interface*, later renamed *Journal of New Music Research*, *Leonardo Music Journal*, and the more recent *Organised Sound*, they will not be reviewed here due to space limitations.

3.1 International Computer Music Conf.

The ICMC was established in the mid-1970s and has been held annually from 1980 onward³. Since then, the ICMC has been one of the main channels for disseminating research on the use of computers in music⁴.

From its inception to 2000, researchers have published a large number of papers related to musical interfaces. Several themes/key terms in current research consistently appeared in the titles of ICMC papers from that period, including:

- The terms "real-time", "real time" or "realtime" appear in the titles of 202 articles;
- The sequence "interact" is used 130 times in paper titles, e.g. as in *interactive* (103 times) or *interaction* (25 times), indicating that the word *interactive* was more commonly used at that time;
- "Control" appears 127 times, including the term "controller", which appears 20 times (once as *microcontroller*, but in that case also in the context of interactive music systems;)
- "Interface" appears 42 times, though around half of the occurrences refer to graphical interfaces for non-interactive software.
- The sequence "gestur", as in "gesture" or "gestural", appears 32 times;
- "Mapping" appears in 10 titles, roughly half the time referring to work related to interactive systems and instruments.

Other topics are less common, though they are still present. For instance, terms related to *haptic interfaces* appear in 7 titles and include the terms *haptic*, *tactile* and *force-feedback*. Similarly, [musical] *robots* appear in 3 titles.

Several papers at ICMC dealt with the above themes early on, as early as 1975. Among them, one can cite works dealing with *interactive electronic musical instruments* [89] or *interactive composition* [25], *gesture and gestural control* [1] [20] [6] [16], including discussions on *performance with gesture interfaces* [23] [101], *mapping* [13], [60], [37], [28], and *force* [20] [39] or *tactile* [27] *feedback*.

Research preparation for writing the book "New Digital Musical Instruments: Control and Interaction Beyond the Keyboard" [72] identified some 220 ICMC references relevant to musical interfaces⁵, out of some 2,100 papers published.

³A. Hufschmitt [45] mentions related conferences in 1974 and 1976, but those proceedings are not available on the ICMA website, with the first available volume being ICMC 1975. No conference was held in 1979. In this paper, we will limit our analysis to publicly available ICMC proceedings from the ICMA website, making a total of 24 conferences between 1975 and 2000.

⁴ICMC proceedings are available online (until 2018) at <https://quod.lib.umich.edu/i/icmc?page=home>.

⁵The list of references is available at <https://www.idmil.org/project/prehistoric-nime/>

¹It appears on the opening page of <https://www.nime.org>, accessed on April 05, 2023.

²For instance, in concerts in NIME 2002 & NIME 2006, as well as in Waisvisz's keynote in NIME 2003.

Recent research focusing on 40 years of digital musical instrument (DMI) design up to 2016 conducted a linguistic analysis of proceedings from three conferences dedicated to computer music: ICMC (from 1974), NIME (from 2001) and the International Sound & Music Computing Conference (SMC, from 2004). It identified 295 ICMC articles between 1974 and 2000 containing six keywords related to DMI design: stability, reliability, durability, compatibility, maintainability and robustness [100]. These numbers attest to sustained activity related to musical interfaces at the ICMC at that time.

3.2 Computer Music Journal

The CMJ, published by MIT Press, was established in 1977 [88] [98] and has since been the flagship venue for all aspects of computer music.

In the 24 years from 1977 to 2000, many CMJ articles dealt with interactive systems and electronic musical instruments⁶. Topics of interest include *interactive conducting systems* [59] [15], *alternate controllers and interfaces* [68] [91] [57] [32] [44], *sensors for musical performances* [24] [77], *musical haptics* [18] [17], *collaborative performances* [47], and *interactive dance systems* [96].

Several CMJ special editions before 2001 focused on “New Performance Interfaces”, namely issues 14:1 and 14:2 (1990) and 22:1 (1998), presenting a comprehensive view of the area thanks to authoritative contributions which, for the most part, are still relevant today. The following quote by CMJ editor S. T. Pope from issue 14(1) attests to the early interest of the journal in NIME-related topics [80]:

This is the first of two special issues that will address one of the major areas of contributions of computer technology to music as a whole - the development of new performance interfaces and instrument paradigms. The other feature articles provide an in-depth focus on this special topic.

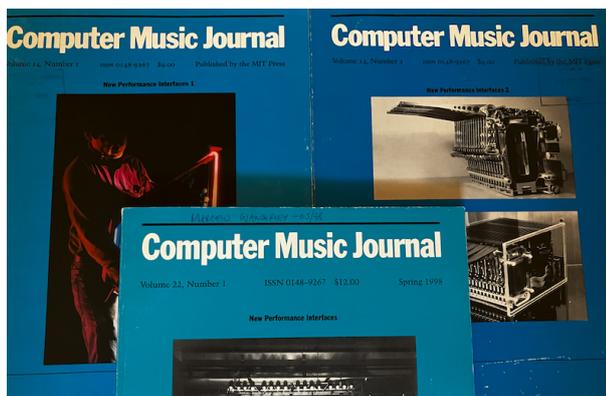


Figure 1: A picture of the partial covers of three CMJ special issues on New Performance Interfaces, 14(2) and 14(2) in 1990 and 22(1) in 1998.

Other interesting CMJ articles take the form of reviews of events focusing on interactive music [86] [61], inspiring

⁶The index of the first 24 volumes of CMJ is available at <http://alinehuf.fr/bibliographie-systematique/index.html> [45]. More recent CMJ volumes are available from the journal’s homepage at <https://direct.mit.edu/comj>, while all the back issues (back to Volume 1) are available through JSTOR: <https://www.jstor.org/journal/computermusicj>

overviews by researchers at the forefront of their fields [4] [82] [67] [115], and in-depth interviews with key actors in computer music [62] [58] [12]. These contributions are quintessential for researchers to get a fuller view of an area beyond research articles in peer-reviewed venues.

3.3 A Few Innovative Developments: ‘85-’89

To provide a rough idea of the richness of the early research on musical interfaces published in academic computer music venues, let us review a few of the developments introduced in the five years between 1985 and 1989. The choice of this period is somewhat arbitrary. It does, though, provide an excellent example of the activity in the area at that time.

In 1985, apart from *the Hands*, a few other innovative interfaces were presented at ICMC. One of them was E. Johnstone’s *the Rolky* [51], a very early version of a multi-touch screen for musical control using a peripheral interface adapter (parallel I/O interfacing) to communicate with a 6502 microcontroller (and no MIDI)⁷. Another early development presented in 1985 was a dance-music interface controlled by myoelectric signals (EMG) by R. Gillett and colleagues [42]. Also of interest were two publications about systems for real-time interactive computer accompaniment, [10] and [105], following the original papers published a year before by R. B. Dannenberg [31] and by B. Vercoe [104].

M. Starkier and P. Prevot presented the *PACOM* in 1986 [99], a MIDI controller in the shape of a mixing desk using various input devices such as potentiometers, sliders, joysticks and ribbon controllers allowing for a wide choice of control options. This console follows earlier attempts by H. G. Alles [2] or by J. Snell [97], but this time it is entirely MIDI compatible (using SysEx messages). A further development that used multiple low-degree-of-freedom devices in a musical interface was R. Vertegaal and colleagues’ “Musician’s Cockpit” [107] from 1996.

D. Wessel and colleagues discussed the control of phrasing and articulation in sound synthesis [114], an essential topic with implications for mapping, and G. Grossman presented an interesting analysis of control mechanisms in mechanical and computer-based tools [43].

A camera-based musical controller, the *Oculus Ranae*, was introduced by D. Collinge and S. Parkinson, providing simple computer vision input to control synthesis (again, no MIDI) [29]. Among several video camera-based musical controllers widely used by the computer music community before 2001, one can cite T. Demeyer (STEIM)’s *Big Eye*⁸ and A. Camurri and colleague’s *EyesWeb* [21]. D. Rubine and P. McAvinney presented the *VideoHarp*[90], a multi-touch optical-scanning MIDI gestural controller. An extended version of this paper was published in the CMJ [91]. At the same conference, a real-time unit for I. Xenakis’ *UPIC* (Unité Polyagogique Informatique du CEMAMu) composition system was introduced by J.-M. Raczinski and G. Marino [84].

In 1989, the *Radio Drum* (also known as the *Radio Baton*) MIDI controller was introduced by R. Boie, M. Mathews, and A. Schloss [11]. In the same conference, X. Chabot introduced three MIDI controllers and associated software tools: *the Sonar*, *the Pendulum* and *the Airdrum* [23], and D. Keane and P. Gross introduced *the MIDI baton* [56], one of several conducting controllers presented around that time [72].

Since 1990, a plethora of instruments have been proposed, many of them discussed in [87] and in [72]. Though there

⁷Johnstone would later create a foot control interface for seated performers called *the PodoBoard* [52].

⁸<https://monoskop.org/STEIM>

are too many to cover here, two examples of long-term developments stand out:

- The series of articles by H. Katayose and colleagues [55] [54] and [53], on various iterations of advanced systems using a variety of sensors for musical interaction.
- The long-term work at ACROE, France, widely published in early computer music venues and lasting for over 40 years, blending theory and practical developments related to musical systems based on haptic feedback, sound and image synthesis using physical models [18]. A review of ACROE's research has been presented by C. Cadoz in his keynote address during NIME03 [19].

Interestingly, the terminology used by the computer music community at that time differed somewhat from the one currently used today. For instance, *controller* and *control surface* were commonly used to refer to *interface*; as already mentioned, *interactive* (adjective) seemed to be preferred to *interaction* (noun), while *gestural control* was widely used in the sense of *musical human-computer interaction*.

These terminology variations must be considered in meta-reviews using automated tools when collecting information about older publications to obtain an accurate view of past research.

4. OTHER SEMINAL REFERENCES

Despite the importance of musical interface research in the ICMC and the CMJ, many important works dealing with NIME topics were presented in elsewhere. For instance, an article published by B. Pennycook [78] describes many of the early interactive systems of the 1970s and 1980s and discusses significant issues related to musical interfaces. Other references include A. Mulder's analysis of alternate controllers and how they can be designed to adapt to performers' movement capabilities [74], and J. Ryan's article on instrument design at STEIM [93].

Similarly, critical pre-NIME references exist in the form of books [26] [87]⁹ and websites gathering resources, e.g. [73], though, unfortunately, the latter are primarily obsolete today.

Several academic theses from the 1970s to 2000 also dealt extensively with NIME issues: [38] [41] [22] [85] [34] [106] [35] [65] [46] [75] [71] and [66], among others.

The following sections focus on five primary sources of information outside the ICMC and CMJ, describing the efforts made and their impact on NIME research.

4.1 STEIM Symposia, Controllers, Tools

The *STudio for Electro-Instrumental Music* (STEIM) in Amsterdam, the Netherlands, was established in 1967¹⁰. Directed between 1981 and 2008 by M. Waisvisz, it was a critical player in all aspects of interactive music and new interfaces for musical expression. Waisvisz presented a comprehensive history of STEIM developments in his keynote address at NIME03¹¹.

Quoting M. Waisvisz [108]:

⁹Specifically, the chapter on Musical Input Devices, pages 617-658.

¹⁰<https://monoskop.org/STEIM>

¹¹Available at <https://www.youtube.com/watch?v=RJ4z1iNA7eI>, in 6 parts.

STEIM was created as a laboratory for the research and development of the modern practice of electronic music. Right from its inception some twenty-five years ago, STEIM has supported an "instrumental" approach to the performing of electronic music. It means that in STEIM's view, this kind of music only attains its definitive form once it reaches the concert platform and that, via direct, physical action, the performing music-maker must create sound in the public's presence.

STEIM has been called "*the land of alternate controllers*" [3] or "*a legendary institution of live electronic music*"¹² due to the intense activity around new musical interfaces [92], mainly through residencies of composers, musicians and artists who would develop their novel interfaces in close collaboration with STEIM's staff. An excellent overview of numerous projects from the first 25 years of STEIM is provided in [109].

Three STEIM symposia were held from 1984 to 1986 [86] [61]. These are especially interesting for NIME as many discussions around interactive music performance and instrument design [93].

*The Touch Festival*¹³, organized by S. J. Norman, M. Waisvisz, and J. Ryan, was held in Amsterdam in 1998. It consisted of two main events: a symposium with several guest speakers and the *Touch exhibition*, where STEIM's controllers were displayed. The Touch instruments, including *the Hands*, *the Web* and many others, became a "*big travelling' playable exhibition' with many new instruments*" [8]. The exhibition has been shown in several locations, including at IRCAM, in Paris, around 2000, cf. Fig. 2

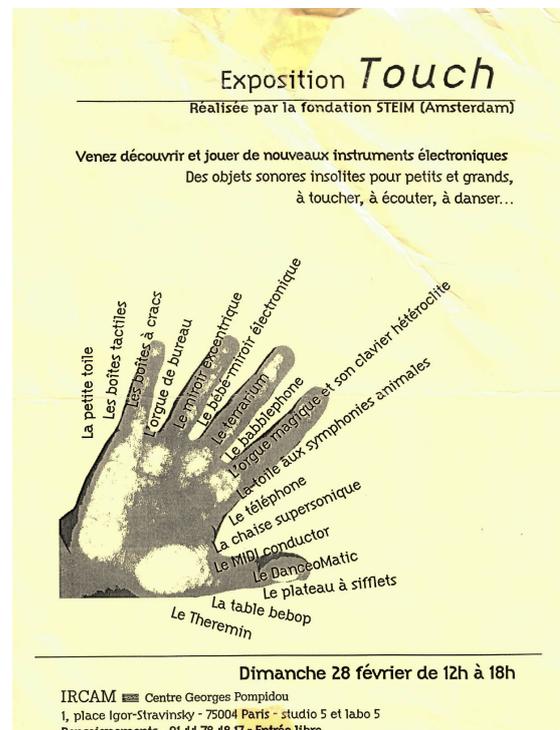


Figure 2: The poster made for the Touch Exhibition at IRCAM in Paris around 2000. Note the number of interfaces displayed at the event, with their names in French.

¹²<https://newmusicusa.org/nmbx/theres-no-place-like-steim/>

¹³<http://www.steim.org/steim/texts.php?id=2>

Thanks to the development of tools for musical control, such as the already mentioned software *Big Eye* or the well-known mapping tool *junXion*, as well as for organizing events that had a critical impact on the future of interactive music, STEIM was instrumental in creating a community of practitioners around the idea of real-time computer music performance. Indeed, it is hard to overstate STEIM's contribution to the NIME community.

4.2 Les Nouveaux Gestes de la Musique

In April 1997, the *Centre National de Création Musicale (GMEM)* in Marseille, France, organized a two-day event called "*Les Nouveaux Gestes de la Musique*" with 14 talks by leading researchers and artists, including J.-C. Risset, M. Waisvisz, D. Wessel, C. Cadoz and S. de Laubier, and two round tables on new musical interfaces [111]. A book (in French) with chapters issued from the 1997 talks was published in 1999, edited by the original workshop organizers H. Genevois and R. de Vivo [40]. It is, to our knowledge, one of the first books specifically focused on NIME-related topics. This event, together with the STEIM symposia, was a landmark in the prehistory of NIME. Several of the book's chapters are seminal contributions to the field.

4.3 Trends in Gestural Control of Music

Another early comprehensive overview of NIME-related topics is *Trends in Gestural Control of Music (TGCM)* [113], an e-book devoted to research on musical interfaces. TGCM, cf. Fig. 3, was one of the references cited in the proposal for the CHI 2001 workshop on NIME [81].



Figure 3: Cover of the electronic book *Trends in Gestural Control of Music*, one of the early works dedicated to musical interfaces, released in 2000.

TGCM consists of twenty-four articles, tutorials and case studies on *gestural control of music* (or, as it would be called today, musical interfaces), an extensive bibliography on related issues, with around 500 entries, and a detailed list of resources¹⁴. The e-book articles, formatted for screen reading or printing, included videos and sound examples illustrating the contributions. Topics covered include interface history and design, gestures, mapping, sensors and interaction.

¹⁴Printable versions of the articles in TGCM are available at <https://github.com/mmwanderley2/Trends-in-Gestural-Control>.

One interesting resource in TGCM is a round table with nine music interface pioneers: W. Buxton, D. Buchla, C. Chafe, T. Machover, M. Mathews, R. Moog, J.-C. Risset, L. Sonami, and M. Waisvisz. It is a unique document, a testimony by key pre-NIME designers, researchers, composers and performers on musical interfaces. Their answers are enlightening, discussing how they got involved with the field, how they approached it in their practices, and what they thought its future would be.

TGCM was another instance when a community of researchers and practitioners came together to discuss the field of new musical interfaces. Together with J. Paradiso's "Electronic Music, New Ways to Play" [76], they present a comprehensive overview of the early research on musical interfaces.

4.4 The ISIDM Working Group

The *Interactive Systems and Instrument Design in Music (ISIDM)* working group¹⁵ was established after discussions during ICMC 2000 in Berlin when a group of conference attendees was willing to put together a comprehensive online list of references on interactive systems and instruments. The working group came out of a more focused effort carried out at IRCAM, France, between 1997 and 2001, the "*Gesture Research in Music*" group¹⁶. ISIDM was supported by the International Computer Music Association (ICMA) and the Electronic Music Foundation (EMF) and the website was initially hosted by the ICMA [112].

The ISIDM website, created before the establishment of accessible digital libraries, still has useful introductory texts and extensive lists of references on interaction & performance, sensors & actuators, interface design, mapping, software tools, and dance technology, from pre-NIME papers to more recent references, up to around 2010. A special issue of the journal *Organised Sound* mentioning the ISIDM activities was published in 2002 (volume 7, issue 3).

Though there are no links to the actual papers, NIME researchers can use the ISIDM website as a rich source of off-nime references. For instance, the ISIDM bibliography on interface design has 463 entries, the bibliography on mapping has 83 entries, and the one on sensors has 62 entries, including some of them from NIME conferences. The ISIDM website has been up and running for two decades and is still accessible to this date, though not recently updated.

4.5 Electronic Music and Interactivity

Jörg Piringer's thesis [79], published in 2001 shortly after the NIME workshop, is fundamental in several ways. It a) presents an in-depth overview of the field done, for the most part, *before* it was called NIME and b) compares musical interfaces in terms of three characteristics: *expressivity*, *immersion* and *feedback*. This comparison (chapter 4) is available in English thanks to a translation by C. Brunner [14]. Finally, c) it provides a list of more than 100 interfaces, classified as one primary type of device (e.g. *free-gesture*, *wearable*, *keyboard*, *sting-*, *wind-*, *drum-controller*, etc.)¹⁷.

This work is outstanding due to its comprehensive nature, covering decades of developments, and the choice of analysis methodology that helps the reader make sense of the main trends in musical interfaces up to 2001.

¹⁵<https://sensorwiki.org/isidm>

¹⁶<http://recherche.ircam.fr/anasyn/wanderle/Gestes/Externe/>. The website is still online (April 2023)

¹⁷The complete list is available from <https://joerg.piringer.net/index.php?href=research/research.xml&mtitle=info>

5. IMPLICATIONS

Taking into account *pre-NIME* works¹⁸ will help understand what currents were instrumental in creating the community we know today.

Implications of this research include the following:

- Awareness of the massive amount of early references helps avoid *re-inventing the wheel*, a crucial step in academic research. Conversely, learning from previous works can help the community develop innovative designs based on time-tested pre-existing results. It can, for instance, inspire practitioners to reproduce obsolete or unavailable devices with today's tools [102] without proposing something necessarily *new*, *the curse of the N in NIME*.
- There is a need to federate *pre-* and *off-NIME* references in a unique place, or at least in a few accessible sites that can be easily perused. The field of NIME is broader than the papers published in the yearly NIME conference, and this richness needs to be considered [9]. Though a few works have gone beyond NIME proceedings examining issues related to musical interfaces, e.g. [100] and [70], still many of the works discussing NIME focus exclusively on the contents of the conference's proceedings. Excellent reviews of NIME research, such as [36], a groundbreaking X-ray of the 20 first years of the NIME workshop/conference, could be expanded by including such references to reflect an even more accurate picture of the field.

As a practical outcome of this research, a proof-of-concept website collecting pre-NIME (and eventually, off-NIME) references was developed by J. Tragtenberg¹⁹. We hope that expanded versions of this website will be helpful as a complementary source of references for research on musical interfaces.

- There is a need to consider the terminology used in earlier works, which might differ from the one used today. For instance, *gestural control*, *controllers*, and *control surfaces* were used extensively in the computer music community before *musical interfaces* became the *de facto* term representing this field of research.
- There is a need to value research dealing with topics that are not mainstream in other conferences. For instance, reports on extended practice with new musical interfaces, which were relatively common in computer music venues (e.g. the CMJ interviews with composers and performers or the ICMC studio reports) are enlightening to NIME designers. Similarly, there is crucial value in reports on innovative designs & engineering solutions leading to the provision and availability of innovative, responsive and reliable tools for musical expression, even when these do not undergo formal user evaluation.
- Given the availability of automatic translation tools, accessing texts about musical interfaces originally written in other languages becomes a reality. A few seminal works in French and German were mentioned in this paper, but many more exist in those and in other languages. Taking into account relevant works from other languages and cultures can furthermore help defy "the hegemony of the computer and electroacoustic music history narrative, helping to break barriers

¹⁸As well as *off-NIME* works, i.e. NIME-related works published in other venues since 2001.

¹⁹<https://github.com/anonymoussnimer/off-nime>

and widening the way their history is understood" [30]. Initiatives such as the Latin American NIME Research Network (LATAM NIME)²⁰ are excellent steps in this direction.

- Finally, it is time to update the narrative about the origins of NIME to reflect a more inclusive perspective recognizing the diversity of sources that led to the community we know today. Integrating different points of view in the rich tapestry of NIME helps *de-colonize* the field from a unique inheritance, reference, or time. The field of NIME can be seen as a "*tiers-instruit*" [95], a mix of different identities that makes it unique.

6. LIMITATIONS

This paper has several limitations, which should be addressed in future works. Among them:

- It focuses on academic research (published research papers), and does not mention non-academic sources.
- It addresses works from a given time (mid-1970s - 2000) and from one domain (computer music), leaving out earlier and later works as well as works in other areas.
- The proposed website collecting off-NIME references only links to PDFs of papers freely available online. Papers with restricted copyright are consequently not accessible.

7. CONCLUSION

This paper reviewed early research on NIME-related topics in the computer music community. Focusing on two of its earliest venues, the ICMC and the CMJ, it was shown that a wealth of research directly related to current NIME interests predates the NIME workshop/conferences and are still relevant today. Five other seminal sources of information on musical interfaces were revisited, showcasing the work of several researchers in this area over more than two decades. A list of implications of this work was presented, aiming to help the NIME community broaden its scope and acknowledge multiple sources of relevant material in their research.

8. ACKNOWLEDGMENTS

Part of this work stems from text written for a book project started several years ago in collaboration with J. Chadabe, one of the keynote speakers of NIME 2002, a project unfortunately aborted by his passing in 2021. Apart from being an exceptional person and a true pioneer, Joel's contribution to interactive computer music (and, therefore, to NIME) cannot be overstated.

Several colleagues read earlier versions of this paper and provided helpful insights, including F. Berthault, F. Calegario, P. Castine, D. Keislar, A. Mulder, and J. Tragtenberg. The three anonymous reviewers and the meta-reviewer made suggestions that helped focus this work. Many IDMIL students commented on this paper's several drafts: M. Fradkin, E. Meneses, Z. Piao, K. Pocius & C. Reimer. Thank you all.

I would like to thank INRIA - Lille, France (Stéphane Huot and colleagues at the Loki Team), for a 12-month INRIA International Research Chair that made part of this

²⁰<https://latam.nime.org/>

work possible. Several research grants from the Natural Sciences and Engineering Research Council of Canada (NSERC) provided ongoing support for this research.

9. ETHICAL STANDARDS

The author is a member of Computer Music Journal's Editorial Advisory Board since 2016, a position that does not involve pecuniary or other direct benefits. The author does not identify any other conflicts of interest related to this work. No artificial intelligence tool was used to write this text. Grammar and spelling checks were done using Grammarly Premium.

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